SCIENCE ABSTRACTS.

SECTION A.—PHYSICS.

VOL. XIX
1916

Issued by
THE INSTITUTION OF ELECTRICAL ENGINEERS,
VICTORIA EMBANKMENT, LONDON, W.C.;
Compiled and Edited by the Institution, in association with
THE PHYSICAL SOCIETY OF LONDON;
With the Co-operation of
THE AMERICAN PHYSICAL SOCIETY,
THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, and the
ASSOCIAZIONE ELETTROTECNICA ITALIANA.

EASTMAN KODAK CO.
LIBRARY
KODAK PARK

LONDON:
E. & F. N. SPON, LIMITED, 57, HAYMARKET, S.W.
NEW YORK:
SPON & CHAMBERLAIN, 123, LIBERTY STREET.

ERRATA.

Section A.—PHYSICS.

Abstract No. 160, line 1: *for* P. T. Daniell, *read* P. J. Daniell.
Abstract No. 234, line 1 : *for* A. A. Pfund, *read* A. H. Pfund.
Abstract No. 247, line 1 : *for* T. Huerlinger, *read* T. Heurlinger.
Abstract No. 470, line 5 : *for* appartus, *read* apparatus.
Abstract No. 908, p. 339, line 17 : *for* *Lim* *read* Lim.
Abstract No. 965, line 5 : *for* at l/t^2, *read* as l/t^2.
Abstract No. 997, line 8 : *for* Michelsen, *read* Michelson.

CORRIGENDUM.

Abstract No. 1043 : author's correction in Phys. Rev. 8. p. 753, 1916.

ACCESSION
No. 4801

EDITOR.

L. H. WALTER, M.A.

ABSTRACTORS.

G. E. Allan, D.Sc.
C. E. Allen, A.M.I.E.E.
R. Appleyard, M.Inst.C.E.
C. Arnold.
C. Ashmore Baker.
C. O. Bannister, A.R.S.M.
T. Barratt, D.Sc., A.R.C.S.
Prof. E. H. Barton, D.Sc., F.R.S.E.
E. Bellini, D.Sc.
H. Borns, Ph.D.
F. J. Brislee, D.Sc.
M. A. Bulloch, A.C.G.I.
C. P. Butler, A.R.C.Sc., F.R.P.S.
F. T. Chapman, D.Sc., A.M.I.C.E.
J. D. Coales, D.Sc.
W. R. Cooper, B.Sc., A.I.C.
R. Corless, M.A.
W. J. Crawford, D.Sc.
A. Daniell, M.A.
J. S. Dines, M.A.
J. S. Dow, B.Sc.
J. Erskine-Murray, D.Sc., F.R.S.E.
Miss A. Everett, M.A.
A. Findlay, M.A., D.Sc., Ph.D.
E. E. Fournier d'Albe, D.Sc.
A. E. Garrett, B.Sc.
C. S. Garrett, D.Sc.
E. Griffiths, M.Sc.
W. H. Grinsted.
F. J. Harlow, B.Sc., A.R.C.Sc.
T. Harris, B.A., B.Sc., A.R.C.S.
H. H. Harrison.
H. M. Hobart, M.Inst.C.E.
H. H. Hodgson, M.A., B.Sc., Ph.D.
J. B. C. Kershaw, F.I.C.
W. N. Y. King, A.C.G.I.
F. C. A. H. Lantsberry, M.Sc.
L. Lownds, B.Sc., Ph.D.
T. M. Lowry, D.Sc., F.R.S.
A. J. Makower, M.A.
H. W. Malcolm, D.Sc.
Miss J. Molyneux, M.A.
R. E. Neale, B.Sc., A.C.G.I.
E. A. Owen, B.A., M.Sc.
W. C. S. Phillips, B.Sc.
T. H. Pope, B.Sc.
T. S. Price, D.Sc., Ph.D.
E. C. Rimington.
J. Robinson, B.Sc., Ph.D.
F. Rogers, B.A., M.Sc., D.Eng.
F. R. C. Rouse.
H. S. Rowell, B.Sc., A.R.C.Sc.
A. Russell, M.A., D.Sc.
E. K. Scott, A.M.I.C.E.
P. E. Shaw, B.A., D.Sc.
F. E. Smith, A.R.C.Sc.
S. G. Starling, B.Sc., A.R.C.S.
J. J. Stewart, M.A., B.Sc.
W. H. Story, M.A.
G. W. de Tunzelmann, B.Sc.
E. O. Walker, C.I.E., M.I.E.E.
T. F. Wall, D.Sc., M.Eng.
R. J. Wallis-Jones, M.Inst.C.E.
J. W. T. Walsh, B.Sc.
L. H. Walter, M.A.
W. E. Warrilow, A.M.I.E.E.
A. Wilkinson, B.Sc.
I. Williams, M.Sc.
A. B. Wood, M.Sc.
D. Orson Wood, B.Sc.

ALTERATIONS AND ADDITIONS IN LIST OF JOURNALS.

The List remains as in 1912. The following are Additions, and Alterations in Addresses, etc.

ABBREVIATION.	FULL TITLE.	PRICE.	PUBLISHERS, OR AGENTS.
Air	Air	Single copy, 3d.	3, Arlington Street, London, S.W.
Astron. J.	Astronomical Journal	—	Boston, Mass.
Astron. Soc. Canada, J.	Royal Astronomical Society of Canada, Journal	—	Published by the Society, 198, College Street, Toronto
Aviation	Aviation and Aeronautical Engineering	$1.50 per annum, single copy 5 cents	The Gardner, Moffat Co., 120 West 32nd Street, New York
Canada Roy. Soc., Proc.	Proceedings of the Royal Society of Canada	—	Published by the Society, Ottawa
El. Engineering	Electrical Engineering	—	Publication discontinued
Hill Obsy. Bull.	Bulletins of the Hill Observatory, Salcombe Regis	—	—
Indust. Management	Industrial Management (late Engineering Magazine)	Single copy, 25 cents; 16s. 6d. per annum	140–142, Nassau Street, New York
Rev. Gen. d'Él.	Revue Générale de l'Électricite. (An amalgamation of "La Lumière Électrique" and "La Révue Électrique"	50 francs per annum	12, Place de Laborde, Paris
Soc. spettroscop ital., Mem.	Memorie della Società degli spettroscopisti italiani	—	Published by the Society, Catania
Union Obsy. S. Africa, Circ.	Circulars of the Union Observatory of South Africa	—	—

SCIENCE ABSTRACTS.

Section A.—PHYSICS.

JANUARY 1916.

CONTENTS.

GENERAL PHYSICS.

PAGE
1. Thermo-balance. *K. Honda* 1
2. Electro-magnetic Vacuum Balance. *J. S. Anderson* 1
3. Errors in Levelling. *W. Bowie* 2
4. Young's Modulus by Sonometer. *A. Guillet* 2
5. Harmonic Analysis of Barograms. *F. Vercelli* 2
6. Length of Invar Steel Wires. *L. Carnera* 2
7. Harmonic Analysis. *H. O. Taylor* 2
8–12. 2
13. Air-resistance. *M. Panetti* 3
14. Air-resistance. *F. Burzio* 3
15. Motion of Bodies through Fluids. *C. H. Lees* 3
16. Theory of the Gyroscope. *H. Lamb* 4
17. Measurements of Thickness of Soap Films. *A. Hagenbach & W. Rickenbacher* 5
18. Hottest Region in the United States. *G. H. Willson* 5
19. See-saw of Pressure, Temperature, and Wind Velocity. *R. C. Mossman* ... 5
20. Internal Reflection as a Source of Error in the Callendar Sunshine Receiver. *E. R. Miller* 5
21. Atmospheric Pollution in Towns. *J. B. C. Kershaw* 6
22. Rotation of the Earth. *H. Glauert* 6
23. Variation of Latitude at Rome. *E. Bianchi* 7
24. Observations on Ice Structure. *O. D. v. Engeln* 7
25. The Constant of Aberration. *G. Boccardi* 9
26. Astrophotometry with Photoelectric Cell. *P. Guthnick* 9
27. Series in Corona Spectrum. *P. Carrasco* 9
28. Variations of Solar Faculæ. *H. Arctowski* 9
29. Variations of Faculæ and Sun-spots. *H. Arctowski* 10
30. Albedo of the Moon. *J. Evershed* 10
31. Identification of Minor Planets. *L. Picart* 10
32. Radial Velocity of Andromeda Nebula 10
33. Stellar Radial Velocities and Solar Motion. *C. D. Perrine* 10
34. Faint Star with Large Proper Motion. *R. Innes* 10
35. Measurement of Proper Motions with Blink-microscope. *R. Innes* 11
36. Orbital Elements of Eclipsing Variables. *J. Q. Stewart* 11
37. Orbital Elements of Eclipsing Variable SX Draconis. *W. van B. Roberts* ... 11
38. Inequalities in Period of RT Persei. *R. S. Dugan* 11
39. Orbit of Spectroscopic Binary B.A.C. 5890. *F. H. Parker* 11
40. Distribution of Spectroscopic Binaries. *C. D. Perrine* 11
41. Formulæ for Computing Spectroscopic Binary Orbits. *G. F. Paddock* 12

PAGE
42. Light-changes of R Coronæ Borealis. *E. C. Pickering* 12
43. Light-curve of RZ Cassiopeiæ. *E. Paci* 12
44. Supposed Proper Motions of Stars near M 11. *E. E. Barnard* 12
45. Colour Index of S Cephei. *H. S. Leavitt* 12

LIGHT.

46. Lens Refractometer. *H. F. Dawes* 13
47. Precision Artificial Eye. *H. E. Ives* 13
48. Gyro-telescope. *C. Dienstbach* 13
49. A Revolving Cloud Camera. *O. L. Fassig* 13
50. The Modern Range-finder. *F. J. Cheshire* 14
51. Reflective Power of Pigments in the Ultra-violet. *C. Cochrane* 14
52. Dispersion in the Region of Long Wave-lengths. *H. Rubens* 14
53. Propagation of Light. *R. Gans* 14
54. Intermittent Vision. *C. V. Raman* 15
55. Impulsive Production of Wave Motion. *L. Zehnder* 15
56. Resolving Power of Interferometers. *H. Nagaoka* 15
57. Nickelled Glass Mirrors for Ultra-violet Photography. *R. W. Wood* 15
58. Sharpness of Photographic Images. *O. Tugman* 16
59. Resolving Power of Photographic Plates. *O. Tugman* 16
60. Artificial Illuminants for Photography. *K. Mees* 16
61. Photographic Efficiency of Illuminants. *L. A. Jones, M. B. Hodgson, & K. Huse* 16
62. Use of Thermopile for Photometry. *H. E. Ives & E. F. Kingsbury* 17
63. Variation of Hefner Lamp with Atmospheric Conditions. *E. Ott* 18
64. Thiele's Phase in Band Spectra. *H. S. Uhler* 18
65. Comparison of Wave-lengths by Interference Methods. *W. F. Meggers* 18
66. Energy Distribution in Spectrum of Carbon and Mercury Arcs. *E. S. Johansen* 19
67. Light Emission in the Arc and Spark. *J. Kramsztyk* 19
68. Measurements of Wave-lengths in Iron Spectrum. *K. Burns* 19
69. Cobalt and Nickel Furnace Spectra. *A. S. King* 20
70. Crossed Spectra obtained by Combinations of Interferometers. *H. Nagaoka* 20
71. Interference of Crossed Spectra. *C. Barus* 20
72. Widening of Spectrum Lines by the Doppler-effect. *H. Nagaoka* 21
73. Fine Structure of Mercury Lines. *H. Nagaoka* 21
74. Width of Spectrum Lines. *A. Landé* 22
75. Spectrum of Uranyl Ammonium Chloride. *E. L. Nichols & E. Merritt* 22
76. Spectrum of X-rays. *B. Cabrera* 22
77. Absorption of Constituents of a Beam of Röntgen Rays. *J. J. Thomson* 23
78. Recoil of RaD from RaC. *A. B. Wood & W. Makower* 23
79. Velocity of Electrons expelled by X-rays. *C. G. Barkla & G. Shearer* 23

HEAT.

80. Thermal Conductivity of Refractories. *B. Dudley, Jr.* 24
81. An Aneroid Calorimeter. *H. C. Dickinson & N. S. Osborne* 25
82. New Method for determining Specific Heats. *E. J. Hartung* 25
83. Variation of the Specific Heat of Solids. *A. H. Compton* 25
84. Change of Specific Heat with Temperature. *W. M. Thornton* 26
85. Characteristics of Radiation Pyrometers. *G. K. Burgess & P. D. Foote* 26
86. Emissivity of Metals and Oxides. *G. K. Burgess & R. G. Waltenberg* 27
87. Emissivity of Metals and Oxides. IV. Iron Oxide. *G. K. Burgess & P. D. Foote* 27
88. Incandescent Solids with Subnormal Infra-red Emission. *W. W. Coblentz* 28
89. Isothermals of Neon. *H. K. Onnes & C. A. Crommelin* 28
90. Principle of Similitude and Molecular Physics. *W. B. Hardy* 29
91. Temperatures obtained with Liquid Helium. *H. K. Onnes & S. Weber* 29
92. 30
93. Latent Heat of Dilution. *A. W. Porter* 30
94. Vapour Pressures of Sulphur Dioxide and Nitrous Oxide. *G. A. Burrell & I. W. Robertson* 30
95–97. 30

ELECTRICITY AND MAGNETISM.

PAGE
98. Origin of the Earth's Charge. *W. F. G. Swann* 31
99. Conductivity and Luminosity of Flames. *H. A. Wilson* 31
100. Carbon Consumption in Electric Arc. *W. G. Duffield* 33
101. Mode of Studying Damped Oscillations. *D. Robertson* 33
102. Silent Discharge in Gases. *S. Sachs* 34
103. Radiation of Sparks from Oscillators. *J. de Kowalski* 34
104. Thermoelectromotive Force of Iron Alloys. *T. S. Fuller* 34
105. Vibration Electrometer. *H. L. Curtis* 35
106. Thermal Instruments for Current Measurement. *W. H. Eccles & A. J. Makower* 35
107. A Highly Sensitive Electrometer. *A. L. Parson* 36
108. Phase Difference of Sine Currents. *G. Lignana* 36
109. Distribution of Alternating Currents in Iron Conductors. *L. Lombardi* 36
110. Magnetic Study of Mechanical Deformation. *H. Hanemann & P. D. Merica* 36
111. Saturation Value of Intensity of Magnetisation. *E. H. Williams* 37
112. Temperature Coefficient of Magnetic Permeability. *R. L. Sanford* 37
113. Magnetic Testing of Bars. *A. Campbell & D. W. Dye* 38
114. Magnetic Survey of Pacific Ocean. *L. A. Bauer & W. J. Peters* 39
115. Localisation of Projectiles—Ozil Method. *Buffon & F. Ozil* 39

CHEMICAL PHYSICS AND ELECTRO-CHEMISTRY.

116. Thallium-Selenium System. *T. Murakami* 40
117. Reciprocal Solubility of Copper and Lead. *B. Bogitch* 40
118. Platinum-Osmium Alloys 40
119. Heterogeneity of Steel. *H. le Chatelier & J. Lemoine* 41
120. Corrosion of Molybdenum Steels. *L. Aitchison* 41
121. Reaction between Acheson Graphite and Magnesia. *O. L. Kowalke & D. S. Grenfell* 41
122. 42
123. Manganese-Nickel Alloys. *A. D. Dourdine* 42
124. Coefficient of Viscosity of Anisotropic Liquids. *R. Schachenmeier* 42
125. The Theory of Gas Reactions. *H. Löwy* 42
126. Molecular Heat of Metallic Sulphides. *L. Rolla* 43
127. Changes of Mass involved in Formation of Complex Atoms. *W. D. Harkins & E. D. Wilson* 43
128. The Hydrogen-Helium System. *W. D. Harkins & E. D. Wilson* 44
129. Experiments on Supersaturated Solutions. *M. Jones & J. R. Partington* 44
130. Distribution of Electrolyte between Water and Solvent. *H. J. M. Creighton* 44
131. Osmotic Pressure in Solutions of Electrolytes. *S. J. Bates* 45
132. Viscosity of Colloidal Solutions. *E. H. Büchner* 45
133. Grouping of Emulsion Particles. *M. v. Smoluchowski* 45
134. Heats of Dilution of Concentrated Solutions. *W. S. Tucker* 46
135. Measurement of Conductivity of Electrolytes. *W. A. Taylor & H. L. Curtis* 46
136. Law of Saturated Solutions. *A. Colson* 46
137. Passivity in Connection with Ferrous Alloys. *H. W. Moseley* 47
138. Deposition of Lead from Lead Nitrate Solutions. *F. C. Mathers & A. McKinney* 47
139. Formation of Magnesium Sub-oxide. *F. C. Frary & H. C. Berman* 47
140. Electro-deposition of Nickel. *C. W. Bennett, C. C. Rose & L. G. Tinkler* ... 48
141. Classification of Iron by Nitric Acid. *S. W. Young & E. M. Hogg* 48
142. 48

AUTHORS' INDEX.

Aitchison, L., 120.
Anderson, J. S., 2.
Arctowski, H., 28, 29.
Barkla, C. G., 79.
Barnard, E. E., 44.
Barus, C., 71.
Bates, S. J., 131.
Bauer, L. A., 114.
Bennett, C. W., 140.
Berman, H. C., 139.
Bianchi, E., 23.
Boccardi, G., 25.
Bogitch, B., 117.
Bowie, W., 3.
Büchner, E. H., 132.
Buffon, 115.
Burgess, G. K., 85, 86, 87.
Burns, K., 68.
Burrell, G. A., 94.
Burzio, F., 14.
Cabrera, B., 76.
Campbell, A., 113.
Carnera, L., 6.
Carrasco, P., 27.
le Chatelier, H., 119.
Cheshire, F. J., 50.
Coblentz, W. W., 88.
Cochrane, C., 51.
Colson, A., 136.
Compton, A. H., 83.
Creighton, H. J. M., 130.
Crommelin, C. A., 89.
Curtis, H. L., 105, 135.
Dawes, H. F., 46.
Dickinson, H. C., 81.
Dienstbach, C., 48.
Dourdine, A. D., 123.
Dudley, Jr., B., 80.
Duffield, W. G., 100.
Dugan, R. S., 38.
Dye, D. W., 113.
Eastman, E. D., 122.
Eccles, W. H., 106.
Einstein, A., 96.
v. Engeln, O. D., 24.
Evershed, J., 30.
Fassig, O. L., 49.
Foote, P. D., 85, 87.
Frary, F. C., 139.
Fuller, T. S., 104.
Gans, R., 53.
Glauert, H., 22.
Grenfell, D. S., 121.
Guillet, A., 4.
Guthnick, P., 26.
Hagenbach, A., 17.
Hanemann, H., 110.
Hardy, W. B., 90.
Harkins, W. D., 127, 128.
Hartung, E. J., 82.
Hildebrand, J. H., 122.
Hodgson, M. B., 61.
Hogg, E. M., 141.
Holborn, L., 92.
Honda, K., 1.
Hudson, O. F., 142.
Huse, K., 61.
Innes, R., 34, 35.
Ishiwara, J., 8, 97.
Ives, H. E., 47, 62.
Johansen, E. S., 66.
Jones, L. A., 61.
Jones, M., 129.
Jones, R., 9.
Kershaw, J. B. C., 21.
King, A. S., 69.
Kingsbury, E. F., 62.
Konstantinowsky, D., 11.
Kowalke, O. L., 121.
de Kowalski, J., 103.
Kramsztyk, J., 67.
Lamb, H., 16.
Landé, A., 74.
v. Laue, M., 95.
Leavitt, H. S., 45.
Lees, C. H., 15.
Lemoine, J., 119.
Lignana, G., 108.
Lombardi, L., 109.
Löwy, H., 125.
McKinney, A., 138.
Makower, W., 78, 106.
Mathers, F. C., 138.
Mees, K., 60.
Meggers, W. F., 65.
Merica, P. D., 110.
Merritt, E., 75.
Miller, E. R., 20.
Moseley, H. W., 137.
Mossman, R. C., 19.
Murakami, T., 116.
Nagaoka, H., 56, 70, 72, 73.
Nichols, E. L., 75.
Onnes, H. K., 89, 91.
Osborne, N. S., 81.
Olt, E., 63.
Ozil, F., 115.
Paci, E., 43.
Paddock, G. F., 41.
Panetti, M., 13.
Parker, F. H., 39.
Parson, A. L., 107.
Partington, J. R., 129.
Perrine, C. D., 33, 40.
Peters, W. J., 114.
Picart, L., 31.
Pickering, E. C., 42.
Porter, A. W., 93.
Raman, C. V., 54.
Rickenbacher, W., 17.
Roberts, W. van B., 37.
Robertson, D., 101.
Robertson, I. W., 94.
Rolla, L., 126.
Rose, C. C., 140.
Rubens, H., 52.
Sachs, St., 102.
Sanford, R. L., 112.
Schachenmeier, R., 124.
Schidlof, A., 12.
Schrödinger, E., 10.
Schultze, H., 92.
Shearer, G., 79.
v. Smoluchowski, M., 133.
Stewart, J. Q., 36.
Swann, W. F. G., 98.
Taylor, H. O., 7.
Taylor, W. A., 135.
Thomson, J. J., 77.
Thornton, W. M., 84.
Tinkler, L. G., 140.
Tucker, W. S., 134.
Tugman, O., 58, 59.
Uhler, H. S., 64.
Vercelli, F., 5.
Waltenberg, R. G., 86.
Weber, S., 91.
Williams, E. H., 111.
Willson, G. H., 18.
Wilson, E. D., 127, 128.
Wilson, H. A., 99.
Wood, A. B., 78.
Wood, R. W., 57.
Young, S. W., 141.
Zehnder, L., 55.